



<b>Near-Infrared Reflectance Spectroscopy (NIRS) Analysis of Soil Samples</b>			
<b>Libby, MT Parkers Cleanup Site. August 22, 2000</b>			

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NIRS was measured on samples and the presence of tremolite-richterite amphibole was determined by the presence of hydroxyl absorption features, in particular those features at 1.393 and 2.3 microns. The presence of the tremolite-richterite was visually estimated into categories none, trace, minor, major by the apparent strength of the feature presence. Post analysis will be done back in the lab to give actual feature strengths. Abundances of tremolite-richterite is rough semi-quantitative and can be refined by feature strength computations, if necessary. For this report, the maximum error is in the 2% range. Residual water in the sample can reduce the apparent feature strengths, so the samples were dried first to minimize this issue. The samples dried further under the spectrometer light source.

Sept. 1, 2000 R. N. Clark:			
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The NIR INDICES are computations on absorption strength using absorption features due to richterite-tremolite-winchite amphibole minerals.

NIR INDEX 1 = relative absorption strength of the 1.393 micron feature times 10.

The scaling by 10 brings the INDEX to approximately 1 for pure amphibole but will vary by grain size. Feature strength and INDEX is not a linear function of abundance.

NIR INDEX 2 =  $(bd_{139} + bd_{23r}) * f / 0.1514$

where  $bd_{139}$  - band depth of the 1.393 micron feature (from INDEX 1)  
 $bd_{23r}$  = band depth of a narrow portion of the richterite/tremolite/winchite absorption superimposed on a presumed larger 2.3 micron feature due to vermiculite/biotite common in the Libby deposit  
the factor  $f = 1$  if the broad 2.3 micron feature exists and is at least the same strength of the 1.393 feature.

This relationship was derived from lab spectra of construction of richterite and vermiculite.

NIR INDEX 1 is a useful index when other minerals interfere in the 2.3 micron region, like muscovite and chlorite, which have been observed in the Rainy Creek alluvial fan.

NIR INDEX 2 is useful when abundant biotite is present, or field spectroscopy is used with a light source where water in the atmosphere renders the 1.39 micron region most useful.

A high value of either INDEX 1 or 2 can indicate tremolite/richterite/winchite presence.

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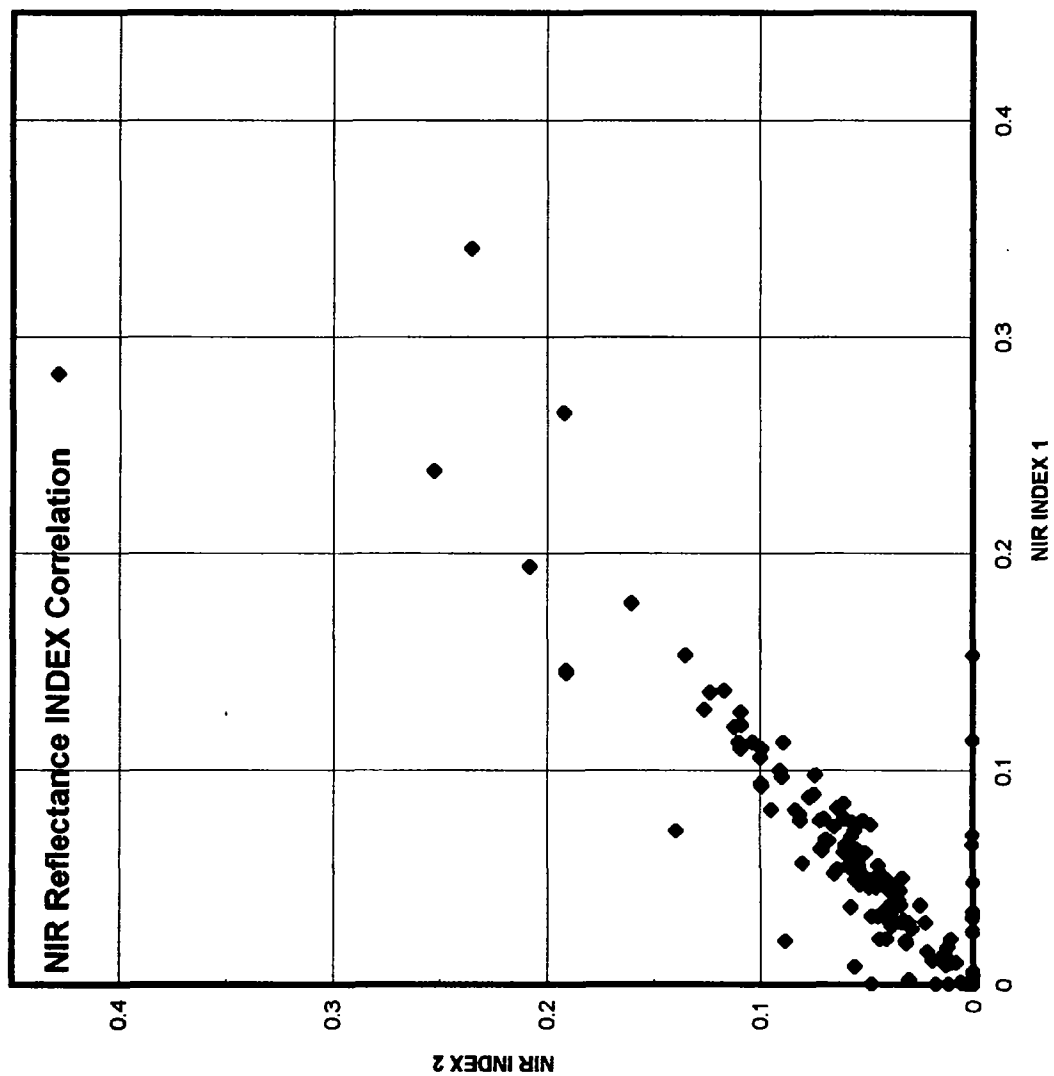
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